SE EXTC III Analog Electronics-I 31 May 2014 (BGS)

QP Code : **NP-18628**

(3 Hours) **[Total Marks : 80**

N.B.: (1) Question No. **1** is **compulsory**.
(2) Attempt any **three** questions out of remaining **five**.
(3) **Figures** to the **right** indicate **full** marks.
(4) Assume **suitable** data if required and **mention** the **same** in answer sheet.

1. Solve any **five** :— **20**

(a) Explain effect of temperature on characteristics of PN junction diode.
(b) Why LC oscillators are preferred for high frequency applications ?
(c) Find R_B and R_C for the circuit shown to obtain $V_{CE} = 5V$ and $Ic = 2mA$

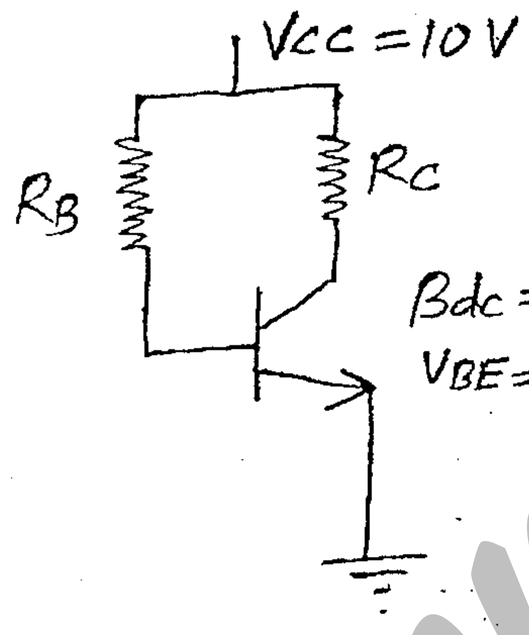

Fig. 1C

(d) In n-channel MOSFET $V_{DS} = 5V$, $V_{GS} = 5V$, $V_{BS} = 0$, $W = 10\ \mu m$, $L = 5\ \mu m$, $k'n=100\ mA/V^2$ and $V_{TO} = 1V$. Calculate its drain current for channel length modulation factor λ of 0 and $0.25\ V^{-1}$.
(e) Draw and explain small signal hybrid-Pi model of BJT including early effect.
(d) Differentiate between BJT and MOSFET.

2. (a) Find I_{CQ} and V_{CEQ} for the circuit shown in **figure 2a** if $\beta = 100$ **10**

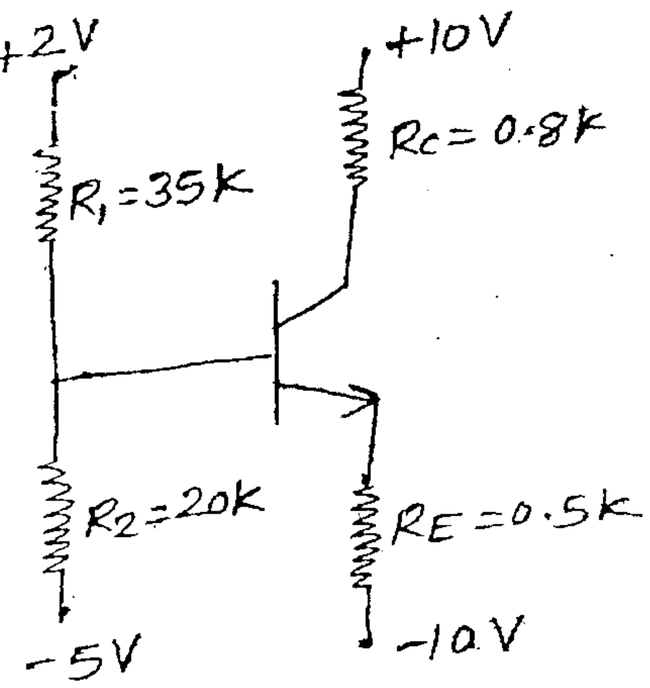

Fig 2a

(b) Draw and explain energy band diagram of MOS capacitor in accumulation, depletion and inversion region. 10

3. (a) Draw and explain working of transisterized Wien Bridge Oscillator. 10

(b) The JFET shown in **figure 3b** has parameters $I_{DSS} = 8mA$ and $V_P = -4V$. Determine V_G, I_{DSQ}, V_{GSQ} and V_{DSQ}. 10

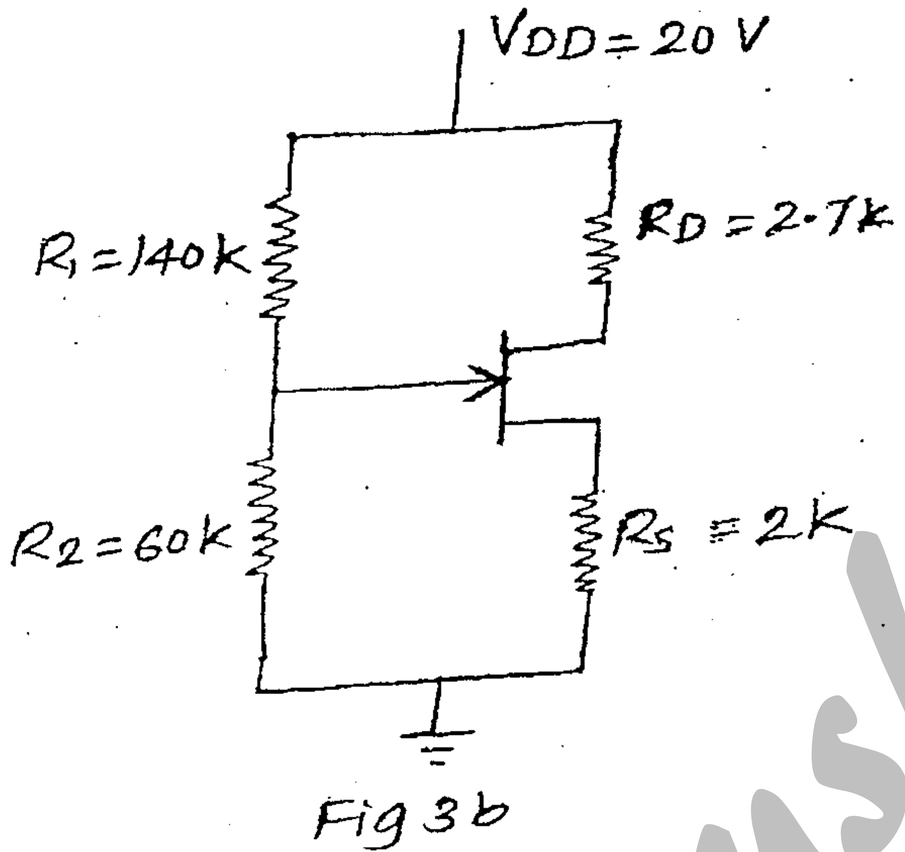

Fig 3b

4. (a) For the common gate circuit shown in **figure 4a**, the NMOS transistor parameters are $V_{TN} = 1V$, $kn = 3\ mA/V^2$ and $\lambda = 0$. 10

(i) Determine I_{DSQ} and V_{DSQ}

(ii) Calculate gm and ro

(iii) Find the small-signal voltage gain $A_V = \frac{v_0}{v_i}$. Assume Cc_1 and Cc_2 acts as short circuit for small-signal analysis.

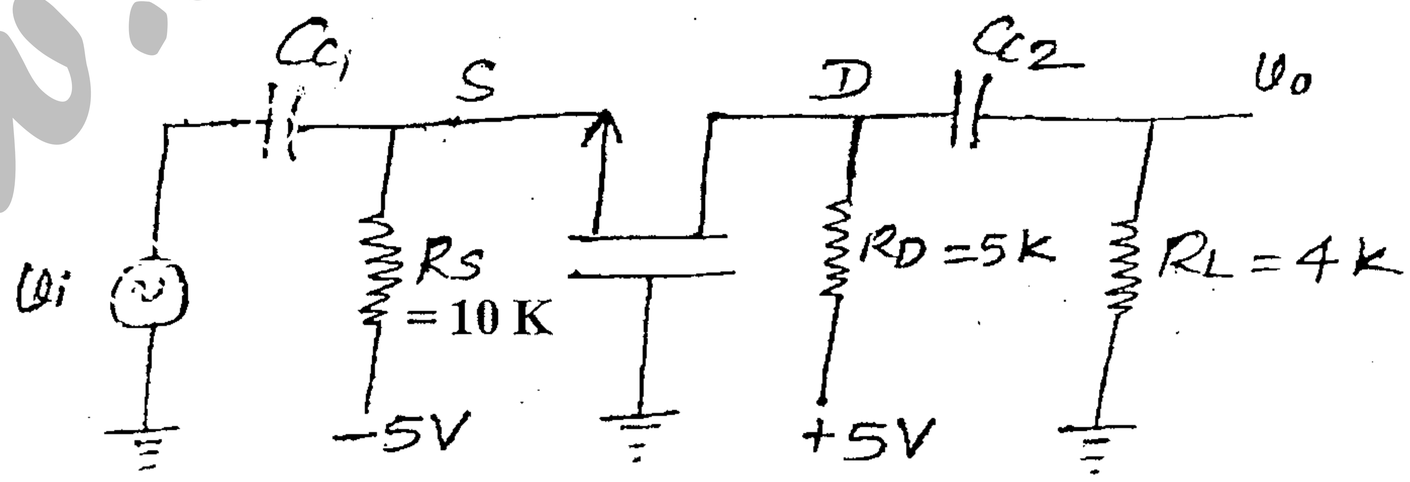

Fig 4a.

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(b) The parameters of the transistor in the circuit shown in **figure 4b** are $\beta = 100$ and $V_A = 100$ V. **10**

(i) Determine the dc voltages at base and emitter terminals.

(ii) Find Rc such that $V_{CEQ} = 3{\cdot}5$V and

(iii) Assuming C_c and C_E act as short circuit, determine small-signal voltages gain

$$Av = \frac{v_0}{v_s}.$$

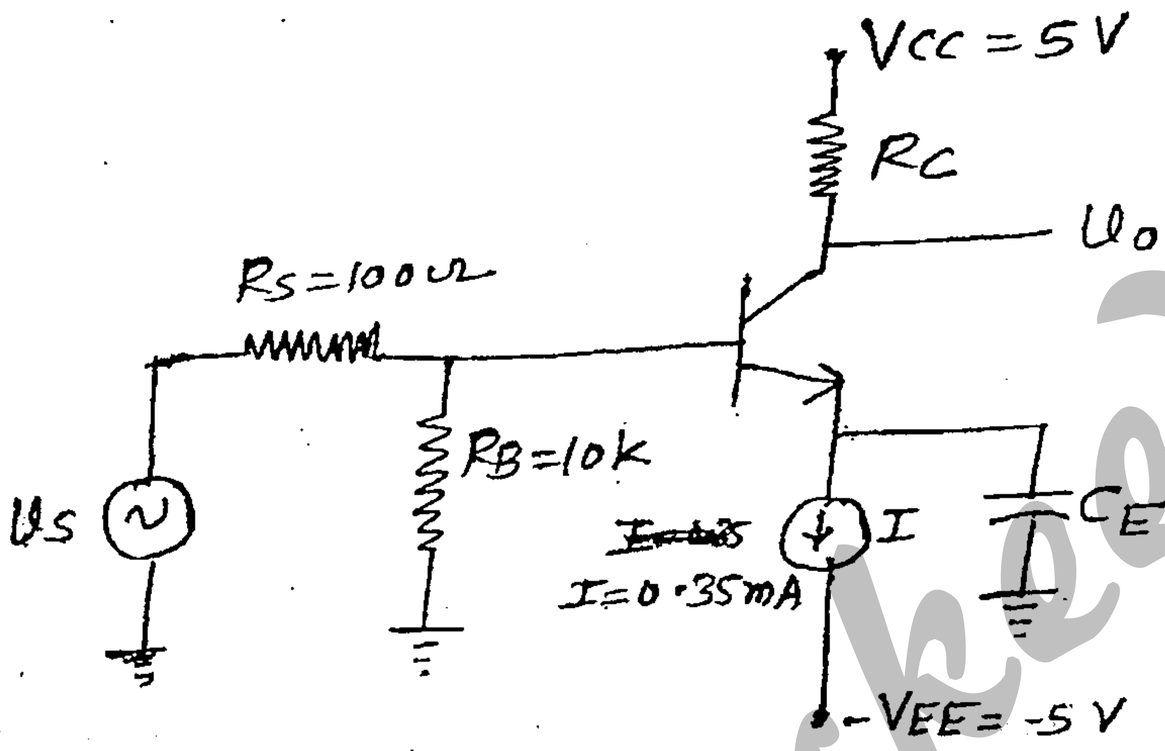

Fig 4b.

5. (a) Derive expression for voltage gain of NMOS source follower circuit. **8**

(b) For the common base amplifier shown in **figure 5b**, derive expression for voltage gain, current gain, input resistance and output resistance using hybrid-π model. **12**

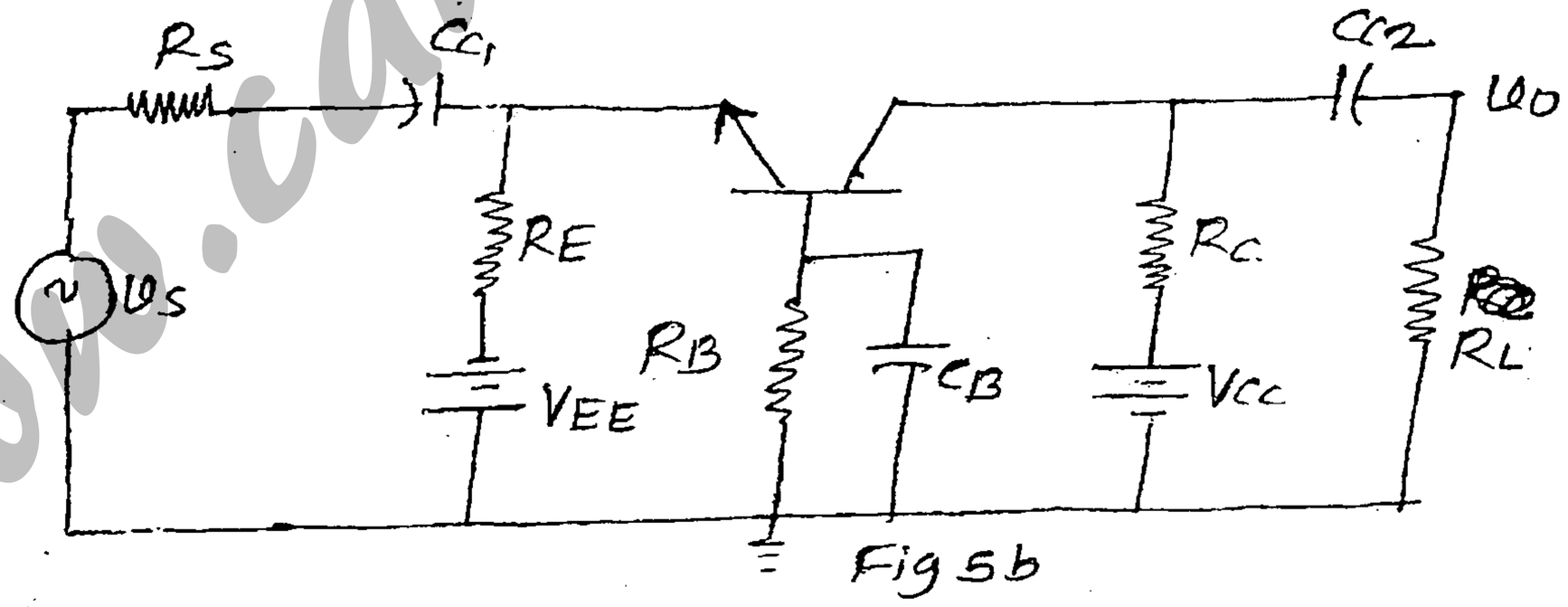

Fig 5b

6. Write short notes on any **three** :— **20**

(a) Series and shunt clippers

(b) Twin-T oscillator

(c) MOSFET operation

(d) Construction and operation of varactor diode.
